Notebook, N-05-07-20

This notebook covers the period July-August 1905. There is also one dated entry from January 1906. All entries are by Edison. The book contains notes regarding the search for sources of cobalt, which Edison tested as a component of his alkaline storage battery. Included are survey notes of numerous North American mines, along with records of cobalt ore separation experiments. Near the end of the book is a list of battery experiments to be performed. The front cover is labeled "Cobalt." The pages are unnumbered. Approximately 90 pages have been used.

Cobalt Ores —

North American Lead Co Columbus Ohio
Works Fredericktown Missouri make a bye
product concentrate about 50 mesh of 10 to
15 tons daily claim to have immense
deposit — Cone assays according to the
Co's letter of July 20 1905

Lead	4.57%
Copper	8.45
Nickel	3.10
Cobalt	3.59

The 25 lbs sample sent assayed
according to McCrath.

1.87 Cobalt
1.79 Nickel —

571 Miller Very Very Strong Cobalt reaction
(Litchfield) Co Conn near Litchfield
Sample from J T Hubbard see Letter July 11/95
It appears to be pyrrhotite - massive —

570 Miller - from York Co Pa Carroll Twp
Bell mine - sample from pile ready
for shipment
Magnetic full of pyrites Very Very strong
Cobalt reaction

25 Burns Auriferous pyrites, Chapman
mine NC. VV Strong Co or its
Unsprecked fm Montague mine. NY or Nova Scotia

24 Burns Auriferous Pyrites, Henderson
mine NC., or its same as 25
Montague - its unprecked + VVS strong

566 Miller - Very Very Very Strong Co -
from York Co - Carroll Township
Logan mine - surface ore at top of shaft
furnished by Boss Morris
Magnetic - full of pyrites;
This is Longnecker mine & worked -

546 - Lehigh Co Pa Milly Very Very strong
1 mile from Albertus Mary Sauk farm
ore bank - ore from pits
Its a good lean Vermicite, pan it - ?

533 Miller. Very Very Strong Co –
Blair Co Pa Blair furnace East
Allroona Baker mine. ore from dumps
of 2 pits – Limonite ore – reducent,

532 Blair Co Pa Blair furnace or
East Allroona Baker mine.
Ore from No 1 Pit, Lean Limonite –
Very Very strong Co

498 Miller. Cumberland Co Pa
Dickerson Twp Ore bank – Sides of bank
Very Very strong Co Red Limonite,

518 York Co (Miller) Franklin Township
Heck's Mine ore ready for shipment.
Limonite Very strong –

514 Miller – Cumberland Co Pa
S Middleton Tp. Ege bank (Red-ore Co)
ore from bank – Very Very strong
dense Limonite – –

513 Miller Cumberland Co Pa
Middleton Tp – Pepper bank.
from two pt sides + waste dump
Limonite – Very Very strong Cd

511 Miller – Cumberland Co
Middleton Township J. L. Musser
land. Iron pits South side of
Shavers? – Very Very Strong Co –
Limonite –

503 Miller Cumberland Co –
S. Middleton Township. Lukens & Yockey
bank sample furnished by Yockey &
said to have come from property –
Very Strong Co – Dense limonite.
I think may be magnetic try it –

502 Miller - Cumberland Co Pa
S. Middleton Township -
Lukens & Yorkes bank -
On Dump ready to ship -
Very Very strong - Lumpite.

493 - Miller - Cumberland Co Pa
Dickenson Township -
Laurel No 2 Bank - Sides of pit.
Lumpite - Very strong -

492 Miller - Cumberland Co Pa
Dickenson Township -
Laurel No 1 bank - Dump at
Washer average of mine -
Lumpite - Very Very strong Co

48 Muller - Cumberland Co Pa.
Southampton Township
No 1 — Phila & Reading Coal & Iron Co
Sides - Lumonite Very Very Strong Co.

482 Muller - Franklin Co Pa
Southampton Township
Mase or Manno Bank Dump
Very Strong - Lumonite -

457 Muller - Franklin Co Pa
Peters Township
Aspraine Stingers Bank Dump from
acid working Very Very strong Co.
Lumonite -

467 Mills - Franklin Co Pa
Guilford Township
Lime Kiln Bank
Dump - Limonite, Very Strong

438 Mills - Lisbon Township
N Hampshire - Road Between
Sunset Hill house & Franconia Iron
Dump at shaft on farm of
Wm Woods of Boston.
Very strong Co -
Quartz & pyrites well Concentrate
5 or more to one - pan it -
Spanned it & it will easily go 8 to 1

419 Miller Bath Township - N Hampton
Forsythe Mine: Main Cut & Tunnel
Walls & dump -
Quartz, slate, pyrite, some Copper
will Cove 6 to 8 to 1 - pan -
Pennsylvania Co -

This would be 2.7 tons per ton
left in 100 tons Conc

2.6

Sample sent to McCreath marked
No 1 is concentrate from Longreaches
Logan Mine near Dillsburg
Contains

Metallic Iron	60.500
* Sulphur	1.318
Phosphorus	0.010.

The tailings slightly roasted just
enough to darken them + block
were all pyritics, gangue pounded
out and marked No 2
gave Metallic Cobalt 1.31 %

Recd 2 66lb of Longreaches Dillsburg ore
1 66lb shipping ore. The other
66lb gangue with some ore in.
On crushing the gangue found
that if crushed to 1/4 cube
a rich concentrate can be
made assy 50% — The gangue
+ Conc from the 1/4 was crushed
to 50 mesh - The Conc would

work nicely on the belt seperator

The amount of ore in tails
could not be got out very well
on account of dust & small
clinging particles, The 1/4 Tails
would not assay over 100# now
on panning there is scarcely a
trace of Iron Pyrites - Whereas
The Concentrate after working to
raise the assay have some tails
& there shower considerable
Pyrites - This proves that the
Pyrites is practically all in the
iron & that the whole product
of the mine should be crushed to
1/4 inch & rough Concentrated.
Then dried & crushed to & through
50 or 60 mesh & Concentrated on
belt machine - The tailings
Could on Wilfrey Etc -

Took 10 lbs of Longreeker shipping
ore Dried it & Crushed to 50 mesh
& then Took some & Concentrated
with hand magnet to a four

Conc such as belt mag would
Certain do & pbly better —
I took 5lb 6½ oz
Tailings 12½ oz or 14 3/50 %
of gangue & pyrites.
I then panned it pretty clean
& made good Conc on little glass &
dried it. The pyrites weighed
3 oz - I put it on slightly roasting
that its magnetic & on working
this shows ~~[illegible]~~ how lots
of tailo so there cannot be more
than 2 oz or 2½ % of the
shipping ore is pyrites —
Thus if the general assay makes
the dynamite proportion a
failure —

I slightly roasted the pyrites &
made a separation by magnet, the Co in
both were the same there being
no separation

98
2 3/8

Rec'd today from Albertus sample
looking like Wood - from
Herbert Reimert, - nothing in it

McCreath Assays

Nos 1 & 2 are concentrate & Tails from Logan-Longneckers mine near Dillsburg - I slightly roasted the pyritics Tails -

The Mag Conc was worked on hand magnet well & is as good as the Gelf machine Conc passed by make - it is to be assayed for Fe P & S

The Tails or pyritics are to be assayed for Cobalt only "

No 3 is Bradley ore, Salt Lake City The mine Containing 7000 tons not conc or touched McCreath 6.04% Co 0.16% Ni

No 4 is Bradley Containing 3000 tons - not conc or touched - 6.62 Co - 0.18 Ni -

Nos 3 & 4 sent Aug 4th 95 - Registered mail

No 5 is the 25 lb box of Conc from the North American Lead Co Fredericktown Mo to be assayed for Nickel & Cobalt
McC assay 1.87 % Co
1.79 % Ni

No 6 - Ludwig Mine Wash - near Cobalt - from Mr Henninger - 25 lb box - for McCrath assay for Cobalt
.090 Cobalt

Penna – Nalco on Cobalt –

Bedford & Fulton Coo. p 263
Union Township Under Siderlings
Hill – float Hematite & Manganese ore

Delaware Co Darby Township
Small deposits of Wad occur with
Limonite segregations in the decomposed
hornblende gneiss on Darby road in
the Borough of Darby

Chester Co In Londonderry Township
near White Horse Hotel.
Chloritic Mica Schists with
Manganese in layers

Blair Co Pa Sinking Valley
on lands of Wm Galbraith. in Hopeton
part of Valley Pink Sandstone
Contains 94 Silica 3% Al2O3 Fe 0.170 Co Oxide
Enormous deposit of this sandstone
Very fine grain –

Baker Mine Blair Co 3 miles NE
Altoona – The clay – NE part of
mine is manganeziferous, – McCamey
for the General run of ore 0.102 CoOx

Damourite Slate outcrops at
Hensingerville near Allentown Lehigh Co
along St Thomas Breinigs mine to
between Palisadam Salisbury Cong & the
Magnesian limestone. sometimes
interbedded in the limestone all the new
ores pot, bowl, pipe etc occur in the
decomposed slate. The cobaltiferous
top only contains the ore when mixed
with the bottom clay they stop
very little ore in slate.

Ludwigs new mine. 2nd range of mines near Alberton has a vein of Black Oxide of Manganese 6 to 8" thick. Limestone occurs above the ore.

Letter Hewington sends samples says 16" thick Cobalt 1.33 Cobalt 5.4 and 1 complete W. Smith

Lancaster Co Pa Martic Township J & B Simpsons farm between his house & public road a Magnetic Limonite found also a manganiferous variety containing pyrolusite found in shallow pits in the magnetic ore hill.

Drumore Township Lancaster Co Ore opening in J W Johnsons place about 1 mile SW of Buck Post Office on Mr Lambons place 2/3 mile E of Muddy Run Pyrolusite occurs along with Iron ore

Berks Co Pa on borders of Lancaster Co — Jones mine on lands of the Warwick Reserve 2 miles SE of Joanna furnace & about 1½ miles East of Morgantown & 1/2 M S of the narrow belt of Limestone which parallels Berks Co is Exploration for ore which lies on the same strike as the Morgantown ore pits near to the Jones mine which has an Excavation covering 4 or 5 acres. Large masses Chloritic Slate with pyrite & Calcopyrites Crop out on sides The Quartz Slate is PINK & full of pyrite & Calcopyrites a Trap Dyke is here.

Delaware Co Pa Bethel Township

Good specimens of WAD have been obtained at the garnet mine of Herman Behr & Co located near Greens Creek W of Chelsea

N.Y. Geological Survey part IV
page 121 under wad

Wad found rather abundantly in a narrow range in Columbia Co, it deposited in a marsh & only in the vicinity of a range of slate injected with Quartz Veins which contain Brown spar. When the spar is decomp Manganese remains & frequently retains original shape. The gray color decomp loses the spar & becomes Cellular. The Brown spar of the range contains an unusually large amount of Manganese.

Wad found on Mr Gatts farm in Austerlitz found in a marsh bed dug to depth 16 ft however not deep at extends is not known - the bed is reported to be extensive.

Albedite said to be found 1 mile North of the above in the farm of Judson Park

Wad is found 2 miles East of Green River at the outlet of a Marsh near an excavation made for Schoharie

many similar localities of wad are reported to exist in this vicinity & in the North East part of Berkshire Co.

3/4 of a mile South of Canaan Center on David Parsons farm at outlet of a small swamp. Wad deposit has a depth of 6 to 8 inches. The swamp has an area of 3 to 4 acres & is probably underlaid with Wad.

Wad is found on farm of Joseph Goodsell in Hillsdale another deposit is ~~[illegible]~~ 1/2 mile east of Mr Goodsells.

Wad of Mn is said to found near American lead mine Columbia Co & on the Island of Mt — in pebbles. These boulders & pebbles are scattered over every township in the Valley of the Hudson to Long Island Sound. They seem to have been derived from Columbia Co & the continuation of Massacre rock into Mass — Berkshire & Vermont & they contain the

Pulverent earthy oxide of Manganese
that has remained in the cavities
of slaty gravel where the brown
spar has been decomposed.
The Wad has been deposited in
low grounds & the outlet of
Swamps.
Chubbichy & Hillsdale is the center
of Wad

Gooseberry hill 3/4 mile
East of Delhi in Delaware Co N.Y. Park
Sept 1V N.Y. Survey p. 314 -
is a seam of slaty grit 8 inches
thick containing Earthy black Ox Mang
ZnS & black CuS. Its called
the Coal mine -
There is a stratum about 15" thick
in which Mang ite is disclosed
the stratum is co extensive with
the coloace formation passing thro
Grassy Water Sullivan & Delaware
Co N.Y. its observed at Franklin
Delhi Roxbury Windham,
Durham Monticello Etc.

at Canaan Center ~~and from the~~
Tawson (see pt IV 432 NY Geol Survey)
1/4 to 1/2 mile south of Canaan Center
in Cut of Railroad is beautiful
section of slate rock of purplish
& gray color Quartz Genetrach. This
rock in very elevation. It Quartz
Contain Pyrolusite & where this
is decomposed Earthy Manganese
remains. The occurrence of this
mineral in some quantity in
the rocks of this region accounts
for the abundance of Wad found
in this region.

failed to record counter but the
the first green slate we met
on the road - about 7.5 miles -

597 = miles from Porgh keepie
in Armenia road, 20 ft in a side road
Black green slaty rock - clean across
road - took samples every 6 inches
samples uneven. some three times the wt
of others. In some bit of rock
are brown streaks from 1/8 to 1½ inches wide
somewhat decomposed - lighter than
green rock - Think the brown rock
owned to 5% of the Total
Preliminary test no Co

598 This is the brown slate
described in 597 =
Prelim test no Co

599 1000 ft further along from 598 on main
road - about 20 ft wide - part black +
part red & Castle - left hand road
some Co + Ni

600 - 950 ft from 598 along main road
on right hand road - Quartz showing
Porphyry spar

604 - float,
Gray slate dry ably green wet
about 1½ sqr inches faint Cobalt,

604 Dirac black slate - Walnut size
weak Cobalt,

604 Very green specc, hickory nut. no colors

604 Purple Very little Co - weak -

604 - Quarly Walnut size - very very weak

601 - is same location as 599 - This
is quarly slate streak ably 10 ft or more
wide - lantern brow much wider -
Some little Cobalt some Ni I think,

602 - about 1100 ft further East on
main road left hand side in front
of unoccupied house - 12 ft across -
dull slate outcrop - 8.23 miles for Poughkeepsie
on Amenia road

603 is on same strike 10 ft further East
from 602 - runs right into road all in
front of the unoccupied house -
Auto Counter shows 8.23 miles
from Poughkeepsie - on Amenia road
beyond pleasant Valley -

604 - float in different Colors found
at 603 -

605 - about 1000 ft further from
603 - a 8.60 miles from Poughkeepsie
on auto Counter - This bay represents
its between 2 Red barns 800 ft apart

605 Continued –

Ledge upward to ed barn SW – about 3 ft wide included in this sample is a green slate sample formly fives ft NE running into road

606 – is 25 ft NE from 605 15 ft wide ~~included in a sample of green green slate~~ ~~about 2 ft wide running into road~~

607 further on 15 ft Red slate about 6 ft wide – the slate is closely differentiated by its color –

608 next to 607 is 10 ft of pale green thick thin slate –

609 – 9.2 miles from Pomfret by auto Counter in front of a gate with 2 stone pillars – 10 ft of green –

610 Next to 609 8 ft wide mixed Red + green –

611- float at 610—

612 a little further on 9.33 miles from Poughk on Conts Corner going up hill — quite an outcrop as if blasted for road — This sample is 12 ft wide green & Red, left side of road —
Prelim get Nickel — magnesia — Co on Red — not sure the last two had gold in them —
~~This sample is about 3 feet wide gold on the best~~
~~Little Red~~

613. Same place on right side road sample 25 ft wide — Hebrew find the Red slate very hard & quite sharp from the green
There is pieces of pebbles in the strips — the quartz strong Cobalt strong — other colors strong — nickel — magnesia — nickel green — the red slate shows Co but not nearly as strong — apparently no particles in the green —

Note so far we have found very little slate ~~and~~ stringed with Quartz —
The float in fences show lots of Cavernous Quartz ~~[redacted]~~

614- near top of hill right hand side over the ditch is a ledge of Quartz mixed with slate & has black specks in it which show bright opal which Mr geol speaks of 10.1 miles by Conts from Poughkeepsie very few brown & black opal

614 Continued - we alone have got samples not weathered but did not have proper tools -

" Note its 11.4 miles to Washington Hollow Hotel by our Auto's Cumbler from Poughkeepsie -

615 - at Millbrook: where sidewalk blasted out of ledge of rock - samples all worn Cross about 100 ft - dip 75° clay Thin bedded, has quartz seams at opposite about 5 to 8% quartz seams - dark seam has any brown spar in quartz Color rock generally black to Brown scarcely any decayed - 15.7 miles from Poughkeepsie - Slate hornes Co - of Quartz. some little Cobalt,

616 - Ceremonious Quarry in fence, broken some large pieces picked out lots showing black brown spots.
22.1 miles by Country from Poughkeepsie
~~[illegible]~~

~~[illegible]~~
34" tires - on front axle wheel does
the Counting
618 is Cobalt Blue Slag
Tuesday

619 - From a fence about a mile West
from State Line Village. left hand side
Mixed green slate & Quartz with
Brown & green intermixing -
Which there is considerable Nickel - Cobalt is
rather strong in state - Quartz very faint Co + Ni -

620 about 1½ miles beyond Common Corners
~~State Line Corners~~ 17 miles
direction from Pittsfield - Saw a slate
mine up on a hill on the right hand side
general sample, owned by Howard Hulburt
who lives near mine PO address
E Chatham - - No houses in Common Corners

~~622~~ A same place as bridget
sample of black earth, man at house
said they called it muck or
black earth. The stuff appears C
is nothing but vegetable muck
many days there are several acres

of it all along Valley, they bring down 50 ft or not got to bottom,

621 – At Cavanaw Center found old RR. & place a road where you go under RR. Dent says South along RR to find the Rock Cut Spoken of in Geological Survey. Cement finds cut spoken off but found small one took samples as above its south side of place under RR about 1/2 mile south –

623 – from a wall at Cavanaw Center near the White House & flesh Colored Barn – The farmers around here don't seem to remember if there is any green or red slate near here –

623

624 + 625 - from Cut in RR. on right hand side of the road going west Mountains at Canaan Center & also the Cut in RR now abandoned & spoken of in old geological survey. its 36 ft wide + 12 ft high - good exposure -

626
After leaving Canaan Center went towards North Concord about 1 to 1½ miles & then turned ~~to~~ Accidentally 7 mile. ~~you ft from turn~~ outcrop Common also took sample -

9:15 AM
627 - about 1000 ft beyond 626 first green slate outcrop 10 ft -

9:40 AM
628 - 1000 ft from where we got plum + took water + turned at angle up the steep hill found Anticlinal ledge parallel to road in ditch - green + purple rock side by side, sharp line - pretty

628 = There is a great deal of Ni in the Green rock here of the blue of the NH3 Sol is due to it — With NH4 Sol after it was swept to dry it NH4 oxides, slightly or strongly, tho only lightened it a shade showing altogether needed for a rock like that if it due to green color not 1/3 was taken out by weed it will have to be fused — The Cobalt is rather weak. —

seen the purple is Manganese. was mix the green + purple together — the line between green + purple is very sharp — Every sign of being an immense ledge — Hill is very steep. we walked up — Took a labeled sample here — Very weak Co & Ni in purples — In green very ~~strong blue in NH4~~ Much of Ni — but yet — Nickel after acid quite green still

628

629 — on opposite side road in field big outcrop Quartz with greenish rock in it —

over the hill from 629 - about 1000 ft ~~that~~ in the left fork going to Auxbolty to a house — down the farm 6 or 8 acres flat, land low near swamp. 1 ft muck then hard pan. —

lots green flat float Quartz float & purple along the road —

630 is a bag of float 1/4 mile further in on cinder road —

631 - 1.8 miles from Auskrdatty bay
Auf Counter - outcrop along
road slate & Quartz - right hand side

634 & 634b - 2.3 miles south of
Auskrdatty - float found banks
of stream at bridge across
the road left hand side -
Specimen at Museum shows Cobalt,

635 is from ledge a rock
running into the stream on
opposite side creek - There
is a dam here or was - Specimen test shows Cobalt

633 - from same locality of 634 -
bank of sand yellow light wad
like mineral, Can say how
much - W. Cobalt

637 - float 3 mile from Auskrdatty
on road to Hillsdale after you
make the turn - boulder weigh
2 or 3 tons also from bog quality rock
has a little Cobalt

638 is a ledge running into road
right near 637 - 25 long -

at 635 its full of Canaly +
maybe the stuff spoken in
Geo -

Man digging hole near Hellidahl
says on Geo Parkers farm
they dug a lot of black
stuff also for the pond at
Ice House 639 - is sample
from there — (ie) Ice pond -

Cobalt mine – 35 miles SW of Salmon City Idaho & 110 miles from Red Rock station of Oregon short line in Montana

Address Leon S Griswold
Prof of Geology Missouri School mines

Chemical – Wad Lille Ni & Sb – Mostly Cobalt fine pyrites in Shists

Sto probably where Utah Sample came from Carrying Cu/ Co –

Chemical pyrite from Huaseo
Chili S 20 | As 43 Co 24 Fe 12

at Lewiston, (Hungerford) In Medina Dundalow
Cont. fe specimen minute granules in the gray quartz
Dundalow at Lewiston & Elsewhere black oxide Manganese
is commonly seen in the joints in dameses & traversing
large quartz — Mf Geo Surv 144 Part IV

Cobalt occurs in considerable
quantity in the black Copper ores
of the spanish province of
Leon —
Cobalt has been found in a fissure
in Porphyry in connection with
manganese.

Processes for working arsenical Cobalt ores.

No 1

Roast.

Dissolve in Nitric — filter

Evap nearly to dry — large quant arsenious acid separates

Largely dilute with H_2O — separate the "

Pass H_2S. — Throws down Ar Cu + Bi Sulphides Sn also

Filter + boil off H_2S until Ferrous goes to Ferric

While liquid hot precip CoN_2 by Carb Na in excess as Carbonates + Iron as Ferric hydrox.

Wash precip well.

Digest precip in excess aqueous Oxalic acid — Ferric oxalate dissolves. Ni + Co oxalates insol.

Modifcn

Take sol after H_2S passed. boil + precip the Fe by adding Co or Ni hydroxides, the Fe precips + Ni or Co goes into solution

Or take the solution + add a little Carb Soda + boil — The Ferric gradually precipitates.

Langers Process

No 2 Process

Unroasted ore dis in Nitric
Evap sol to dry
Dissolve in H_2O
Add Carb Soda with constant agitation till Co + other metals precip, this indicated by red color of precip
The precip is Arseniate of Fe
Filter.
Add hot Solution of Oxalate Potash - the whole of the Co is precipitd in a few hours as Oxalate.
If precip contains Arseniate Co it can be removed by Nitric Acid in which Co Oxalate is insoluble
The Iron-Arsenic + most of the Nickel remains in solution.

No 3 Process

Roast ore
Dissolve in Nitric
Filter + dilute with proper quantity H_2O
Saturate with hydrosulphuric acid
Filter again.
Boil.
Use just enough Carb Potash to precip Iron
Dilute with water.
Add small quantity NH4Cl - then Potash
Boil liquid until it no longer gives precip with KOH.
The Red Cobalt solution is then filtered off & yields
Sesquioxide Cobalt on Evaporation.

S

No 4 Process.

Roast ore

Add in successive portions 1 pt ore to 3 pts Bisulphate Potash

Heated to Melting point in Earthen or iron crucible

It becomes pasty

Heat strongly till it fuses quietly + stops giving off fumes of Sulphuric Acid or sulphurous acid given off

Pour out it solidifies.

Break up + decompose in H_2O boiling

Filter from Arsenate of Ferric + Cobalt ox^s which not soluble neutral liquids

Pass H_2S - filter - boil - to drive off H_2S.

Precip by Comb Potash

If no iron in ore add Sulphate Iron to roasted ore

This prevents forming Arsenite Co. as it combines with Fe in preference Lidrigs

No 5 Process.

1 part powdered ore fused in Covered crucible with 3 pts Carb Soda + 3 pts Sulphur at a gentle heat so Co_2S dont fuse but remains in form of a powder – [It fuses its hard to wash]
Repeatedly exhausted with H_2O to removed Sulphuret Na
Treat again with Carb Soda + Sulphur + Exhaust with water –
Dissolve in Nitric or Sulphuric + precip by Carb Soda –

No 6 Process.

Powdered Ore 1 part
deflagrate with 3 pts Nitre
Exhaust with water
What is left dis in Nitric acid, a small part of Iron or rutile undissolved –
Precip. the Copper by Iron
Supersaturate the liquid with Carb Ammonia
Filter from the Iron precip –
Concentrate by Evaporation when considerable Fe will seperate out,
Filter,
Evaporate to dryness –

This seems ok –

NO 7 Process – Used in factory

Powders ors –
Fuse with Chalk & fluorspar
Slag thrown away
Grind fused product very fine. roast in
reverberatory furnace 12 hours till arsenic fumes
all gone.
Digest in HCl
Dilute with H_2O Mix with hypochlorite lime
to convert iron to ferric
Then precipitate with Milk of lime to throw
down Fe & Arsenic.
Wash precipitate & throw it away
Pass H_2S through clear liquid till filtered sample
gives black precip with ammonia.
The Sulphide ppt due to H_2S washed & thrown away
except there are Pb Cu etc in them.
The final Sol. is heated with Chloride lime.
(Hypochlorite ignore) to throw down Co &
afterward with Milk lime to throw down
Ni & Co –

Notes

To seperate Ni from Co roughly Crystalize the Sulphates of K & Co + Sulphates of K & Ni
The Double sulphate of K + Ni being less sol seperate out first - Several recrystallizations will make almost perfect sep

Protochloride Co with free HCl + Chloride Ni
Pass Chlorine to solution this raises the Co to higher stage + has no effect on Ni
Solution should be largely diluted with H_2O
Add Carb Barytes to excess stand 12 to 16 hours with frequent agitation.
The $BaO + CO_2$ O_3 Collect on filter
Wash with cold water
dissolve in HCl hot, remove the Ba by Sulphuric a
Filtered solution contains Ni + Ba remove Ba by Sulphuric - Then precipitate Co + Ni by KOH,

No 8 Process

Patera's Process for Argentiferous Cobalt Ores

Ore roasted in presence of Potassium –
The Roasted with Common Salt,
The Chloride of Silver formed is dissolved
by a solution of Hyposulphite Soda
& precipitated by Polysulphide of Soda
The remaining Solution is used for
Extraction of Cobalt & Nickel –

Notes Separation Co from Ni

Acidulate a chloride sol. with HCl — + add a hot solution of Nitroso-β-Naphthol in 50% acetic acid till the whole of the Cobalt precipt'd. Precip washed Cold then hot 12% HCl & finally in hot water.

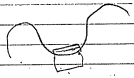
Separation Co from Ni.
In ores — the Co & Ni are precipt'd as sulphides in acetic acid solution — great care taken to eliminate manganese which would interfere with correct estimation of Co. Sulphides are ignited — dis in Aqua Regia. Sol mixed with Ammonium Phosphate 5 times wt of Ni & Co — with 5 pts HCl for every part of ammonium salt. Mix boiled. Vessel removed from flame, while hot NH3 added in small quantities at a time until precip 1st formed & dis solution stirred vigorously when fine purple Crystalline precip which is Ammonium Cobaltic Phosphate are further Clarke. Chem News 48 262 263

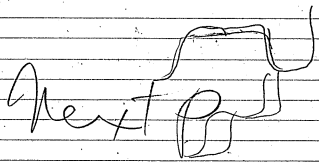
Extraction Cobalt from Manganese ore
Herrenschmidt Dingler's Polyt. 252 - 392
Cobalt ore treated with Ferrous Sulphate
and Enough water to form a paste
The residue said to result on the
oxides of Cobalt & Mn on boiling
the mix a solution of Cobalt &
Manganous Sulphate is obtained
which is seperated from residue
& heated with suitable agent so as
to convert the proto into the per salt,

Seperation of Fe from Co & Ni -
Solution with very little free acid mixed with
NH4 Sulphite in quant sufficient to form a
double ~~salts~~ sulphite with Co & Ni
present sol diluted to 150 cc
mixed with large excess Oxalic a
well stirred & precip formed
redissolves by adding more NH4 Sulphite
Clear liquid mixed with NH4 slight excess
heated gently for few mins filtered &
washed with H_2O containing NH4
Clear liquid drawn off & Ni det
by Electrolysis Bucher S

Extraction of Ni + Co from their ores
Mark's Dingler's P.J. 254 271
Proposes to separate gangue of S or Arsenic ores of Ni Co - by roasting + Blowing air thro in Bessemer Convts until almost all Fe eliminated residue contains 15 to 20% Metalloids Ni Co removed by usual means.

Separation Ni from Co
Mix of the 2 oxides or sulphides free from all other metals, dis in Aqua Regia containing much HCl - largely diluted + saturated with Hg Permanganate of Potash added till permanent Rose Color + then che Ni with Manganese precip by ROH.
The Co Gold is precip from the mixed filtrates + washings acidified by acetic acid by Sulphuretted Hydrogen
The Mix of Ni + Mn oxides dis in HCl NH4 added in excess liquid exposed to air Ni may then be precip by HS. May be used on large scale to very accurate.
D'Elvaux Compt R 92 723.




Next Page

Separation of Ni from Co –

Ni & Co separated in usual way from other metals are then precip by slight excess ammon sulfide. bulk of liquid measured by adding H_2O then dilute Sol KCy added carefully to avoid excess. The Ni sulfide being completely & readily soluble in very dilute KCy & Co sulphide being partially insol. Its easy to see progress of reaction by the clearing of the liquid in which Co sulfide floats & floats. The liquid & filtered & Co S collected & treated in usual way.

The filtrate containing the NiCy is slightly acidulated with HCl or H_2SO_4 whereby the NiCy thrown down thus washed & ignited to NiO.

To separate Qualitatively Ni & Co

Precip by dilute KOH – Collect & precip heat with some KOH, sol of Co present deep blue – filter thro asbestos.

Detection of Ni + Co

NiO remains unaltered when heated with KOH + Iodine – While CoO is oxidized to Co_2O_3 hence if precipitd oxides of Ni Co diss in Nitric + ppt by KOH. Precip heated with Iodine + the oxides be then extracted with NH_4 + Am Chl only the Nickel will go into solution + may be recognized in it by Diammonium Sulphide –

Separation of Ni + Co

Reducing agents act more vigorously on $Ni(OH)_2$ than on $Co(OH)_2$ – Hence KCl secondly diss $Ni(OH)_2$ but is without action on $Co(OH)_2$.

Considerable quantities Co the Ni may be separated as follows – Precip by KOH + Bromine – to precip add few cc KCl sol – shake well at ord temp. The filtrate Evap with Aqua Regia + in presence of Ni gives dec the reactions of the metal when the Ni is in great excess some of the Co goes into solution

Seperation No. Co Vortman
Monatsh. Chem 4 1-9 / Ing. Wilhoe.

Cobalt Sol mixed with NH_4Cl treated with $Na_2H_2PO_4$ with complete oxidation takes place & boil in few mins sol deep red-violet yellow. Contains Co as Luteo-Cobalt Pho Ort — on diluting with H_2O after cooling & adding small quant KOH. Liquid contains nothing but Co + will remain clear but if Ni is it it will be deposited in a short time as hydroxide. + very small quant Co can be detect + Non Verson Ni.

A blue ammoniacal Sol Ni containing very small quant Co usually exhibits after treatment in cold with $Na_2H_2PO_4$ a distinct red-violet color but even if the quantity of Co present is too small to produce this effect. Upon dilution with water + addition of KOH soln filteration from precip $Ni(OH)_2$ will exhibit faint yellow color of quantity not sufficient to show this if present can be detected by adding NH_4S which gives black precip.

002

If the quantity of Co is enough to give strong red color the Co Ammonium compound will be decomposed on boiling depositing Co_2O_3. But use too much NH_4 in 1st instance otherwise excessive amounts KOH will be necessary to form the precipe

Deposition of Co

Conc Sol of Rochelle Salts added to Cobalt Chl until precip 1st formed is redissolved. From this solution the metal is readily deposited.

Titration of Co

Manganous Cobaltous salts can be titrated with K Manganate. a measured val of feebly alkaline sol of K Manganate of known strength is taken & the Mn or Co sol added until sol also colors. The precip subsides quickly with Manganous the precip of peroxide of Mn & in case of Co is Cobaltous Manganate

$CoMnO_3$

~~Cobalt~~
Cobalt Fe & Mn Oxides fused with Borax - Co is the principal one to dissolve -

Separation Ni Co & Fe
Precip all 3 by ammonium sulphide treat with dilute HCl - Solution will be rich in Fe with but little Co Ni
Precip the Fe as basic acetate - perfect sepn of the Fe from the Ni Co is effected more perfectly than by the "Basic Acetate" treatment alone

Separation Zinc Ni Co -
Convert all into formates with great excess formic acid - precip by HS

900

Precip. mixed Chlorides Ni + Co by Cuso4 soln. Suspend precip in H_2O pass chlorine Whole of Nickel will be in filtrate as $NiCl_2$ free from Cobalt

Sepn Co from Ni

Palmer solution of the 2 oxides boiled with H_2O_2 which oxidizes the Co + not the Ni after cooling KE added then HCl + solution is titrated with Na thiosulphate —

Note why not also the Co_2O_3 out by NH_4 OH it will - the NiO not appreciably sol.

Cobalt ppld from Ni by H_2S.

Saturate sulphates of the 2 metals at 0 Centigrade with H_2S: then heat to 100 Cent, Ni Sulphide precipd Co sulphate not decomp - precip however contains some Co even when the amount of free acid is almost sufficient to prevent precip of Ni

H Hambyney Compt R 106 - 132 135 -

Delffs Method –

Precip Co as sulfide from acetate by passing a sol of Nitrate or Sulphate with a grant of Na acetate not quite sufficient to convert all the Co into acetate – but considerable precipitation of Ni is precipitd at same time

Alumina may be seperated from Fe Ni Co by boiling the clear sol of the mixed ferric oxides with Ammonium Chloride –

If same sol as above is boiled ~~for~~ with ammonium sulfide. until NH4 Cl was come off Zinc sulf is alone is precip therefore this is a ready method septy Zinc from Fe Ni Co –

Same sol as above Mn seperated from Fe Ni Co by H2S. Mn is easily precipitd –

Utah Arsenide Ck Shts 7.000 & 3.000 – to the
~~The~~ 3.000 lot. Crushed 100 mesh –
Panned in Water. Very Careful –
71.850 grms float
1 450 " Common with considerable pyrites
920 " Pure pyrites –
by Crushing 85% thro 200 mesh & getting
up a good Concentrate Could do 4 to 1
with considerable loss in Tails.

Guess best way work this ore is to mine
Crush to 2" & pick out best ore
Crush to 100 mesh run off Conc
& Ship. Saving the poor 2" ore
& Tailings from Concts.
If there is gypsum there then with
Charcoal blend burn it into a
Sulphide –
There is too much loss in Concts –
2 to 1 is the limit of saving and to be
kept below 1% – that's going be
different ~~[illegible]~~ – Conc should
be roasted with Charcoal
perhaps.

$$\begin{array}{r} 1450 \\ 920 \\ \hline 37 \end{array}$$

Note, I believe the following the papers are taken from Dana's Mineralogy
H. Ries
1891-01-04

Cobalt at Chatham Co
Smactite 1.35 to 3.82 Co
12.19 to 9.44 Ni
Occurs in Mica slate

~~Skutterudite~~ As Co Co 20%
occurs in Hornblendegranique in
Gneiss in Norway

Cobaltite from 9 to 33% Co
S+As - Occurs in Mica
slate in Sweden

Gersdorfite from 0.26 to 14% Co
S+As occurs in Blende +
galenite at Phoenixville Pa

Cobaltiferous Mispickel
San Baldomero mines at Mt Sorata
Bolivia - also at Inquisivi
bet La Paz + Yungo Bolivia
3 to 5% Co

Syepoorite
S Co 64% Co
from Syepoor near Rajpootanah India
occurs in Shists with pyrrhotite.

Carrolite
Palapsco Mine near Finksburg
Carroll Co Maryland 37% Co
4.5 Ni its sulfide.

Linnaeite 43% Co found in
Chlorite Slate at Mine La Motte
& at Mineral Hill Maryland
with Calcopy Blende Bornite
& pyrite.

Grunauite
S 38 Bi 14 Ni 40 to 22%
Fe 5 Co 11% Cu 11. Pb 7 to 4%
found in Quinly & Calcopyrite

Utah mans ore
Roast in air then charcoal, separate
Magnetically -

Glaucodot
As 43 S 20 Co 24% Fe 12
Occurs in Chlorite slate with Cobaltite
in Province of Huasco Chili
"

Alloclasite
S 16 As 32 Bi 30 Fe 5 Zn 2 Co 25%
Hangovey

Large deposits Wad at Martinsburg
Lewis Co Nevada in Swamp
detto at Blue Hill Bay, Dover, and other
places in Maine -

Cobalt iron Wad found near
Silver Bluff South Carolina
24% Oxide Cobalt 76% Mn

Erythrite
As 38 Co 33% Ni 9% Fe 3%
Earthy Cobalt sometimes in brilliant
Cracks.

Hydrous Basic Arsenicate Ni + Co
Desert of Atacama in veins in
decomposed Diorite As 14 Ni 20 Co 9

Cabrerite As 42 Ni 20 Co 4% Mg 10
in Sierra Cabrera Spain in gangue of
Brownspar which is connected
with Limestone & argillaceous is result
of alteration of arsenides Ni + Co

Kottigite
As 37 Zn 30 Co 7% Ni 2
Occurs botryoidal & mammillate in Germany

Paleraite
Molybdate Cobalt found in
Uranium ore in Joachimsthal -

Dolomite Cobaltiferous Co 7%
Reddish Color Prizium -

Remingtonite
Red colored incrustation occurs
as coating in vein of serpentine which
traverse hornblende & Epidote at
Copper mine near Finksburg Maryland

Cosalite
Co 2 to 4% - with Cobaltite
in Silver mine at Cosala Province of
Sinola Mexico -

Sphenicos Co 1½ to 2% Co in
Serpentine

Forbes Phil Mag IV XXXV 178
Bonyo Ni is only common in
Pyrrhotite which Cobalt common
to Iron Pyrites. Look it up -

Glaucopyrite
As 67 Sb 3.5 Fe 21 Co 4.6%
Cu 1.4
found in mines of Guadalcanal
Andalusia Spain -

Rabdionite - Black oils
Sweden 72.45 Mn 23 Al 2 Cu 14
Co 5% Urals -

Rhagite
Bi 73 As 14 Co 1.47% Saxony

Roselite.
As 50 Co 13% Ca 21 Mg 4 H_2O 10
Saxony

Apathiopyrite.
As 61 Sz Co 15% Ca 4 Fe 16
Hessen Germany

Winklerite
As 11 Cu 13 Co 39% Ni 2½ Fe 2
Ca 5 Si 2.5 H_2O 14
Thunk Comes from Le compen Cobloom
found at Pitia near Motril Spain.

Macfarlanite
As 21 Sb 3 Ag 59 Co 4½ 7%
Ni 2 Fe 3 Zn 2
Silver Point Lake S

Smaltine in Colorado
Amer. Jnl Science [3] XXIII 350
Stanley Mining Co
Gunnison Co Colorado –
Vein of Cobalt bearing minerals smaltine
predominating gray copper.
Source of Commercial ore
Much Calcite in vein in which small
Erythrite distributed. No Silver & no
Ni. Smaltine Contains 11.5 to 15% Co
The Gem & other mines near Silver Cliff
Colorado Contain a number of Nickel-arsenic
minerals & a small amount of Co –

Working Wad – English Pat 4486 –
Jnl Chem Industry p. 235 1882
Wad fine ground intimately mixed 80 pts
ore with 100 pts Bisulphate Soda anhydrous
addition of fuel & Sulphur added
to convert cobalt into Bisulphate
Dry then fuse in furnace
H_2O & SO_4 driven off
then Lime, Mag or Barytes in fine powder
added to remove Cu, Pb, As, Sb. Mass finally
heated then broken up & cooled & percolated
with hot water – to clean solution

add Sodium Sulphide sufficient to precip Co Ni & small amount of Manganese — filter — Concentrate to Dryness Roast Sulfate by Cupellation Make liquid Evap dry Mixed with Charcoal & heated in Muffle furnace to obtain Sulphide Manganese

For process of working Cobalt ore Commercially see Bertram Blount & Blounts book Chemistry for Engineers p 195 196 197 —

They say for Co Ni ores ~~reduce~~ as ore roasted & mixed with Ferric Chloride then Ferrous chl — Bruquette & Cadeine ~~Chloride~~ Chlorinate the CoO to $CoCl_2$ Ted $CoCl_2$ Leached out —

C E Mutchanor
New Philadelphia Ohio
(See Letter) Arsenical Cobalt &
Nickel Very strong Ni & Co —
Showed say Ni 5 to 7% & Cobalt
2 To 3% — Have McCrosth
assay for Ni & Co
There is Cobalt Bloom all over
the weathered Sample —

A variety of Chlorite occurs with Chromite in Serpentine of Green Valley on American River Cañon California pale purple Color
Cr_2O_3 11% NiO ·49 SiO 32% MgO 35%
FeO 1.23%

Pyrosmalite from Gimora Mine Augusta Co Virginia — NiO ·225 CoO ·269 -

To detect Cobalt in large quant Ni — precip all with KOH filter 2d; precip heated with Conc KOH Co due to blue liquid filter thro asbestos
Reichel Zeits, Annal Chem 1880 468-9

Dunite from Jenks Mine Macon Co NC
RW Raymond Jahr f Min 1880 2 Ref 302
Contains Magnetite Chromite. NiO ·35
Corundum Mine. —

Gersdorffite Arsenide Ni Compound found in Crystalline Limestone Amer Chem J 1 328 found — Benahanis prov of Malaga —

Titanferous ores Containing Ni + Co

Chaffey mine near Newboro Co of
Leeds Canada NiO .31% CoO .09
Vanadium .35
Pine Lake ore Godey Lot 35 Con 4
Glamorgan Township Victoria Co
Canada NiO .27 CoO .07
Vanadium .52
Eagle lake Mine Bedford Township
Frontenac Co Canada NiO .22 CoO .05

4 miles S of Millbridge Hastings Co
Canada NiO .26 CoO .04
Vanadium .29
Township of Bonton Renfrew Co just W of
Ottowa River Canada NiO .43
CoO .10 Vanadium .63

New Foundland NiO + CoO .39
N Shore Lake Superior .27 NiO

Dike from Lullerworth Victoria
Canada. to a diabase free from olivine
near Little Maquette Lake .73 Ni + Co -
Dike from Snowden Victoria Co Canada Ca
.51 Ni + Co

Peridotite mother rock of platinum
Weathers to Serpentine.

Copper pyrites of Cornwall Ore
banks contain 0.34 Cobalt,

Rupfernickel Ni 44.7% found in
Granular limestone at Silver Cliff
Colorado –

Carters Corundum Mine Madison
Co. N.C. – Chlorite has .33% Ni

Wood Mine Castle rock Delaware Co
Pa Ni 0.16.

Ni occurs in high granite Mountains
of Sierra Nevada Mtns near Mono
Lake, Extending from Green Creek
north to Castle Peak to North fork
of Rush Creek South of Mt Lyell.
distance of 25 miles a vein
opened in White Wall Mountain
5 miles South of Jiaga Hill –
assayed 34% nickel

Nickel is reported from Vicinity of Carisa Creek Southern California near Desert at White River Kern Co -

Prof Newberry analyzed the Cottonwood Canon Churchill Co. near Lovelock Station Utah & assayed giving only Copper - Newberry gives hydrated arsenate Ni pink Wreckite
33.7 Ni 36% As 24% H_2O

Nickel found at Chatham & other places in Corn Chatham Co Calif mine to called Ni Arsenide 20 to 45% found at Real del Castillo Baja Lower California 400 miles south of San Diego also Copper nickel & Entombed nickel

Co & Ni found in Ludwig & Carters
Copper Mine near Mokoma
Valley Esmeralda Co Nevada
in a black mineral from 4 to 8%
Cobalt to 1.5% Ni its hydrated
Cu 6 to 13% Si 39% Fe 25%

May 2nd 1906 —

Experiments with Darby ore

Took 50 grms of the roasted ore — digested HCl filtered & added Chlorate K to oxy the iron & cause Arsenious to Arsenic acid — also added some $FeCl_3$ — Then by gradually adding KOH + Coil between each addition threw down white arsenate of iron — filtered this off — then I found on boiling again that by diluting a large quantity of $FeCl_3$ came down so it necessary to work with rather dilute solution I finally stopped adding KOH, took a test in test tube with ammonia showed very little iron —

The solution were made dilute & the most of the liquor was separated by decantation & finally balance was filtered — it filter poor & filters horribly bad — However a test of the $CaCl_2$ solution by H_2S showed very little arsenic scarcely a trace — There was some

black precip. probably Cu + Sb —
This process is all right, 80%
Cu can be got by decomposition + it
can be tested so only the exact
amount of nec'ry Cl added
K Chloride used for precipitating or
Na Hypo made by Calcy Hypo + Carb Soda
The precip of Mg arsenate
can be bag filtered roughly +
dried + the Cobalt or Nickel
got out by percolation with
water or Methyl alc which
diss Co + Ni Chlorides —
I also found that 2nd exhaustion
of ores gave very little Co or Ni
hence if time is given + solution
kept very hot it will all dis-
or 3rd Ex by Hypo Regia
gradually gives nothing —

~~Cumberland~~

Standard Consolidated Mine -
6% Cobalt, Grant Co Oregon

Assay	Si	47.51
	S	4 43
	As	17.28
	Al_2O_3	6 12
	CaO	2.88
	CO_2	1.94
	Cobalt	6 34
	Nickel	0.75
	Gold	0.017
	Ag	0.0028

Some Nickel ores obtained from developmental work on mines in Hemlock Floyd Co Virginia also near Webster, Jackson North Carolina

Arsenic Mines US Arsenic Mines Co
now owned Rewald Postoffice
Floyd Co Virginia —

Wad occurs in Bibb Co near Woodstock
Ala - & in iron mines at Stacks
Mills Cherokee Co Ala

Georgia - Cartersville also cave Springs
Floyd Co Etowah, Extensive deposits
Manganese -

North Carolina Madison Co near
Warm Springs Continuous belt
of Mn Ox & Wad 8 miles long
1 to 3 miles wide - Light blue
Manganese ore.
At Caldwell Co 5 miles west of
Lenoir also Pinkins Mine 10
miles W of Lenoir also 10 miles
North of Dobson in Surry Co
NC also 1/2 mile W of Blue
Ridge gap Mitchell Co veins
2 to 4 ft thick of Earthy Manganese
also Nash Co Jackson Co
Chatham Co Gaston Lincoln Cumberland
Coos - Caraburus Co
There occurs a series of beds
of manganese associated
with Kings mt Slate in
Gaston Lincoln & Catawba Coos NC which

are superficially changed to Manganese. Outcrop Clearly by when an old forge on Crowders Creek on W bank of Crowders Mountain

Mn Occurs at Dorn Lands near McCormick South Carolina.

Tennessee Hickman Co also Green Co with Pen Bre at intervals at foot of the Extreme point of the Unakas mountains all the way from Virginia to Georgia.

Manganese is found all down the Chilhowee Mountain range. Mine operated near 6 miles from Elizabethtown Carter Co

Manganese found in the Triassic sandstone trap rock near Clinton Hunterdon Co N Jersey there was a mine opened but for war but was Mn 47%. Fe 3.03 7%. 25% Insol

There are enormous deposits
Wad in Nova Scotia.

Arsenical Cobalt found in Kelsey
mine at Compton Los Angeles Co California
seems rosy red + dark colored earthy
mass no work done although
samples good.

Wad found Woodstock Station
Calhoun Co Ala —

Chatham Cobalt mine
Middlesex Co Conn

The Sterling mine in Gunnison
Co Colorado having Cobalt
is at Gothic,

Jem other mines near Silver Cliff
Colorado Contain Ni minerals —
small amount Cobalt,

Cobalt with Nickel occurs in
Grant Co New Mexico in Bullards
Peak district Burro Mountain

Cobalt occurs at Ludwig & Carters mine (Copper) near Wasson Valley Esmeralda Co Nevada — it a new mineral black manganese 4 to 8% Cobalt & Nickel —

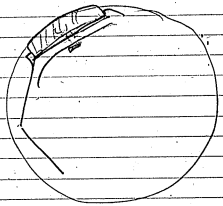
At Dracut near Lowell & middlesex Co Massachusetts vein of ~~[illegible]~~ Nickeliferous pyrrotite opened by Co. Crowell & Butler. Butler — perhaps the Charlestown jewelers samples from there had considerable Cobalt

Wad occurs at Bathurst near Rhapsody Mountain at Quaco & Upham & especially the Cattle place near source of Shaunard River Wad is very abundant,

Massachusetts Wad occurs a foot thick covered only few inches soil West of the Connecticut River it is seen Everywhere, The primary rock Region especially in

Leverett, Whately & Conway
occurs in low places
in Massachusetts — Plainfield
in Talcose slate is a bed of Manganese
at Conway vein black Ox Mn 7 feet wide
S E part of town Quartz gangue
Mn not very abundant Cobalt Sulphur
but explored think found large
granites. Extensive bed or vein
on top of a hill in Hinsdale N Hamp
adjacent rocks not visible
also bed 1½ miles E of Center of
Village of Winchester N Hampshire
black Ox Mn

Pushed on roads near Sharon
Mt road ballast with Cobalt
& Iron slag from a charcoal
iron furnace in vicinity
Bitter investigate the mines



4.32 | good 3 4 5 6 | 2.08

3.6 | 10 5 5 10 | good 3 4 5 6 | 1.7

36 | 12 4 3 1 | 43

32 | 16 8 4 2 1 | 28

2.84 | 5 10 20 40 80 | 2 4 8 16 32 | 1.73

Aug 30 1905 Note on
Experiments for S Bat

Thro 20 all fumes in
flake thro 18 mpa

1 = Dry NaOH, mixed with Glucose.

2 Dry flake washed with NaOH. NH4 Cl.

3 = Take a bad tube from 3 Dups. wash free
NaOH, Dry & fix ends & Corrugate.

4 Same as 3 but only fix ends.

5 Make group with 60 & 40 0004 flake
that Wabrow made during Cents Trip
50 Double Lamps - Burn inside -

6 = Same as 5 but burn outside,
50 Double Lamps.

7 = Same as 5 with Co Salt flake only
burn inside - 50 Double Lamps -

8 = Same as 5 with Co flake & burn outside

9 = Group 60 & 40 0004 mm flake 100
lamps, burn inside - Ends fixed
fixed

Thus 30 ... Kaolin Wanted

10 Same as 9 but burns outside

11 Same as 9 but with Co flake

12 Same as 10 but with Co flake -

13 - 60 + 40 0004 Theoretical 60 + 40 flake
Dry mix - 50 Double Temps - 90% ends,
burns inside -

14 Same as 13 burns outside.

15 Same as 13 but with Co flake burns inside

16 Same as 15 - Co flake burns outside,

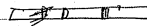
17 - Co flake 50 Double Temps. put Pt plated Caps on end - burns outside,

18 - 60 + 40 - 4 Temps to each section
50 sections -

19 - 60 + 40. 7 green 3 flake 50 Double Temps
burns inside Ends fixed

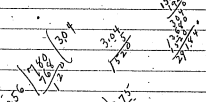
20 Co flake 7 + 3 - 50 double Temps

11 = group with button on each end & forced against mix - and two bands around tube -



to prevent anything - to be nickel wire & put on before after filling + twisted tight about 30 wire 6 bot, & 1 turn + twisted - bars gilt ends or cup + may rounded

12 Drop of about - bars made -



Causes of 1 out of 3 Drops going off—

1st Ends not closed on the mix—

2= Tubes vary in diameter + packing one part loosens on the other part

3rd Swells a little in Center loosening Contact at approach of each end
Trying on a group

4th Bad Contact between flat Ends + the grid after hot test, No

5th Last tube made gets segregated stuff from jarring — No

6th Bad Irons or some iron gives more soluble metal to Rott which goes into tubes, ruining water - [illegible] No

7th= Strips from which tubes made badly plated or weeded flake off— No

8 Amalgamation + destruction of flake

9 = Some improvement in Iron or Rott. discharging flake or coating it

10 - In act Tamping takes a Good more than drops a deposit from Act Hot closes them up almost entirely No

11 - Variation in KOH strength No

12 = The burs are of unevenlength & when tube is packed it is packed hard where burs strike the holder + loose where the burs do not strike -
The tube could be sized by grinding on a mandrel -

13 = All samples from 25 to 35 are good on 2nd from 100 hot, all other Except a few are bad.

14 = Test the green that been in 33% for 1 1/2 yrs

15 - I notice that 123 which was calculated for 72 - by mistake - that mistake of being a Good tube giving 2.0 - gives 745 - that 72 is the Good one being a nickel Cake tube - both had soft Ends - The Nickel of Cake tube when mix rod taken out showed a bright Center whereas (123 Corrected) did not show bright Center - possibly Most Cases Ni flake mix to Contract If flake is fluffy. as there are some good nickel tubes, mixtures No 4. 115
176 178 179 182 185 187 188 189 190
191 192 193 216 218 219 221 -
Either Covering power was poor - or mix shrunk - or there was some deposit, The tube was fine - good Control at Ends - The Color of the inside of Cube black whereas Co Ni flake 123 was clean brown - The Ni flake 72 tube was evidently not changed & Coudent be changed it had bright Center - only Explanation is that it was either pad too tight or the mix shrunk. as the Ni tube is jet black & mix already to it & Ni Co 123 is clean brown that possibly the Ni flake tube was never plated with Coni alloy -

I put hydrogen in both solutions of
AgCl where I am dissolving the mixes.
The Ni flake tube (Ga) has green solution
the Co 123 is brown – The Ni flake tube
dissolves very slow + appears that
pellet is very dense whereas 123
is softer + dissolves much more easily
also the Ni flake has all gone to
powder, whereas the Co 123 the flake
is still rather tough + is several
times larger than the Ni flake –
it is somewhat fluffy also.
I am funny sure the tube with Ni flake
72 was never plated – on acting on 123
+ 72 with HCl – the 72 tube stock looks
like nickel whereas 123 looks like Ni

After Eating 123 MeO with acid only got
120 milligrams of flake + those shaved
Gs 1.25 – a loss of 90% of the flake
in the acid –
What flake that is left seems to be
good under microscope —

162 – Tubes is of group three 162 477
163 642
164 – 557 –

I found 162 - The seam has opened near middle

This explains its low capacity

146 is of group Thus 146 - 592
147 820
148 640

146 has its seam open just like 162 -
This explains low capacity.
I have sent for 147 to see if its seam has
pulled out. Behind 147 is not pulled
out This explains why 147 is so good
148 has seam slightly opened -

I now pick out of groups the good ones & bad
ones & have fixed ~~ago~~ left out electrode &
notice the seams -

Bad Capacity		
68	ok	592
75	ok	640
92	ok	685
96	ok	650
99	ok	620
93	open slightly	707
103	ok	592
115	open slightly	626
119	open slightly	617
127	ok	647
143	ok	662
146	open (?)	592
148	opened little (?)	640
173	opened quite (?)	612

good Capacity		
63	ok	935
65	ok	965
76	"	926
83	"	922
85	"	918
89	"	947
93	"	907
117	"	903
133	"	937
140	"	892
141	ok	910
147	ok	820
173	ok	800

This would go to show that in many cases low capacity is due to opening up seams but in other cases this does not explain and probably aft ends is the cause

I dissolved the flake out 72 + found only 2.55 only whereas alumel Co 12.50 – its all fine – 3 times finer than the NiCr 70/30 –

Changed Counter to read from Australasiz –

2,650
2,650
2,650

.412
60
300 | 2772 (82
2400
372
0

262 | 24420 (94
2358
1064

3500
75
2500
1000
75
25

2 | 220
110
330
165
165
165
0

70 | 330 (4.71
280
500
490
100

4.71
20
94.20

180
70
1,260

560
-280 —
410
210 —

004

1/250

150.000

1500 700

32 14

42 200

140 200

84000

105000

77000

10

2000

32000

6000

Pressure
effect
Pressure depth

300) 25000 (83.3
2400
1000
1

9°

3) 1000
333
1333
1332
1667
2997
1333
3330
3330
3330

44

25
250
50

156
192

24000

230
161.
70

12000

175 — short chg
230 long chg

125

45) 175 (4.45
180

4.45) 230 (5
225

N° Muchairchella

776

Old 2063
7e 1233
3296

.360
2.52

320
7
224.20
448

New Lulu 1952 3.5
" 7e 1550
3.502

48 dollars

5700
62% 504

1740
3524

9000 lbs Sulfate

3502 1.90 2

3296
206

0.59 300

5600
62
1700
3477

4000
62
8000
2480
1480

5600
9478
7.12

3800
62
560
228

48% Iron

44

2500
44% FeSO4

3750 4600
2852
1748

57
82
64
53 960 (62
418
420

4600
62
5000
2000
3000
2760
240

5000
62
1000
3000
3000

105
185
525
840
105
19425

256 850 (33
768
82

708 746 (105
708
38

30 567 (188
30
267 376
240 188
27 188
225

448
33
1344
1344

1970
192
3940
1773
1970
37824

3 14784
4928
1972

2 378
189
567
126
2835
1134
3675
70875

188
12
376
188
225

32

185 6000 (324
555
450
300
300

35

25 567 (22
50
67
50

22
14
4
22
20

80 lb ton –

7 gms.

144
1008

4500

3 amp 1

446
338

192
1250
960
384
1920
240.000

2–

76
600
450

5000 HPhw

288
21
288
576
6048

3) 240
80
320

192
152 – gms Ni
1008 gtrow

250 –

144
21
144
288
3024

20) 5000 (250 –
40
120
34
288
34
152
864
9792 – Nickel –
6912 – Iron

192
152

144
46
152
576
691 –

288
33
152
576
864
4608
48
4

N
N
N
N
N
N
N

new 1152 ni – tubes 320 grids 480
1008 fe pkt 302 " 240

old 9792 ni pockets 604 grid 480
6912 fe " 302 " 240

1008
302
240
1550

1152
320
480
1952

979
604
480
2063

9792
604
480
10876 – total old Ni

6912
302
240
7454 – total old fe

691
302
240
1233

1152
320
480
1952

60

160 - water per ton

320 - for 2 Ton Lime due 25 miles hour

600
66
30000
36000
67000

603) 740 (1.23
603
1436
1300
24

123
185
615
984
1230
2275

1680
192
3360
1680
0

2236

4) 1300
325

25 1/6

322) 2286
288
3480
3220
260
144

2) 322
161
483

70
7

4 - 12
144

45
25
360
90
126
3) 420
168

168
10
1600

3.63
2541

2.541
20
50.80

766

58
32
32
122) 580 (4.75
488
920
854
66

325) 2236 (7
2275

766
475
3830
5362
3064
363850

7 gms